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NASA TECH BRIEF

John F. Kennedy Space Center

Rocket Borne Instrument to Measure Electric Fields Inside Electrified Clouds

The problem:

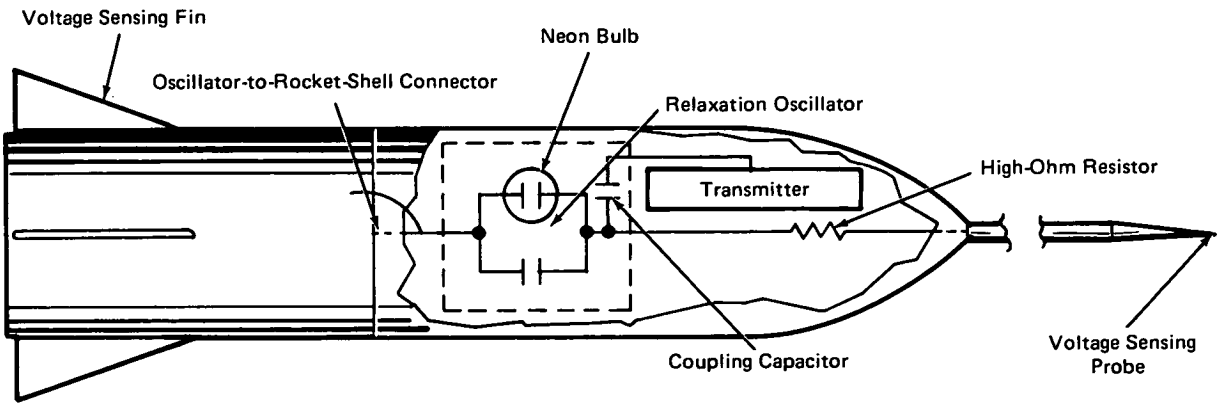
It is difficult, if not impossible, to measure the electric field of storm clouds by ground-based observations. Yet without this information, the probability of lightning discharges cannot be determined. Direct measurements of electric fields in storm clouds require that an aircraft penetrate the clouds at several levels. This technique is hazardous due to dangers of high turbulence and possible high lightning activity associated with these clouds.

The solution:

A relatively simple electric field measuring system is mounted on a small rocket and consists of two voltage probes, one extending from the nose and the other on a tail fin. The electric field through which the rocket passes is determined by the potential difference between the probes.

How it's done:

The rocket and electric field sensing circuit shown in the illustration provide a novel electric field measuring apparatus. The probe with a very fine point mounted on the nose of the rocket senses the voltage produced by the electric field through which the rocket passes. The sharp tail fin serves as a reference voltage sensor. As the rocket passes through the atmospheric electric field, a corona current is produced which flows through the probe. This current is nonlinear with regard to the electric field. To eliminate this nonlinearity, the current from the probe is passed through a high-ohm resistor. The voltage drop across the resistor is large compared to the voltage drop between the corona point and the environment. Thus, the corona current measured is proportional to the electric field to a practical degree.



Atmospheric Electric Field Measuring Rocket

(continued overleaf)

A relaxation oscillator, consisting of a capacitor connected in parallel with a neon bulb, is in series with the resistor. The oscillator produces a chain of pulses of frequency proportional to the corona current through the circuit.

A transmitter, capacitively coupled to the oscillator, sends the signals to a ground-based computer. Since the electric field in a cloud varies rapidly with position, readings are transmitted every 10 meters to allow a charge pattern to be derived from the data.

Notes:

Requests for further information may be directed to:

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Reference: TSP73-10176

Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning non-exclusive or exclusive license for its commercial development should be addressed to:

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